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Immunity in Cattle Vaccinated with Brucella Abortus Strain 19 and a Note Comparing this Strain with 45/20

by

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In a previous paper Edwards, de Ropp and McLeod (1945) described the immunological properties and infectivity of *Br. abortus*, strain 45/20, in cattle. They found that a vaccine prepared from this strain conferred considerable immunity against infection with virulent *Br. abortus*.

The present paper describes an experiment to test, in a similar way, the immunizing value of strain 19 (Ministry of Agriculture No. 1 vaccine). The vaccine tested was obtained from the Ministry's routine issue and it will be shown that it produced a high degree of immunity in cattle against test doses of virulent *Br. abortus*, which infected all of 19 unvaccinated controls. Further, after exposure to infection and following parturition, the milk of vaccinated and control animals was examined weekly, for ten weeks, for the presence of infection and, except for two animals which failed to resist infection, the milk from the vaccinated group remained free from *Br. abortus*, whereas infection was detected in the milk of all the controls.

Materials and Methods

ANIMALS AND ACCOMMODATION.—Fifty maiden heifers, reared at this station and ranging in age from 18 to 23 months, were used; 35 were Ayrshires and 15 were British Friesians. Prior to the experiment these animals were consistently negative to the agglutination test for *Br. abortus*. They were divided into five groups of ten and each group was housed in a separate building, which was bird-proof. At the entrance to each building there was a small ante-room where personnel and equipment entering or leaving could be disinfected. Each of the five units, A, B, C, D and E, had a separate cattle attendant and the animals were identified by the letter of the unit they occupied and a serial number. They were kept in the buildings throughout the course of the experiment and were subjected to the following procedures:—

VACCINATION.—On 13.8.42 the 20 heifers in units D and E were injected subcutaneously with 5·0 ml., of the Ministry of Agriculture's anti-abortion vaccine No. 1 (*Br. abortus*, strain 19). A viable count of a sample of this vaccine showed it to contain approximately 12,000 million organisms per ml.

The 20 animals in units A and B acted as unvaccinated controls while the ten animals in Unit C, which were neither vaccinated nor infected, provided a check on the efficiency of the methods of isolation.

MATING.—Using two bulls, mating was commenced on October 18th, 1942. One bull was used for the animals in units A and E, the other for those in units B and D. In unit C, five of the heifers were served by the A, E bull and five by the B, D bull. Forty-two of the 50 heifers were effectively served between October and December, 1942, and the others, with the exception of four which were infertile, by February, 1943.

EXPOSURE TO VIRULENT INFECTION.—On April 13th, 1943, when the majority of the animals were in about the fifth month of pregnancy, those in units A, B, D and E were exposed to infection. For this purpose *Br. abortus*, strain 544, described by McEwen (1940) as a fully virulent strain, was used. A 48-hour culture on bacto-tryptose agar was washed off in Ringer's fluid and adjusted in opacity to match tube 10 on Brown's scale. This suspension was diluted tenfold and one hundredfold and viable counts of both suspensions were made by three separate workers. The mean of the readings showed that Brown $\frac{\text{tube } 10}{10}$ contained about 1,500 million viable organisms per ml., and Brown $\frac{\text{tube } 10}{100}$ contained about 150 million viable organisms per ml. The infective dose was administered by placing 0·1 ml. on the surface of the conjunctiva; the animals in units A and E were given the small test dose containing about 15 million viable organisms and those in units B and D the large test dose of about 150 million viable organisms. Tests carried out in guinea-pigs by the method described by de Ropp (1945) confirmed that the strain used was fully virulent.

AGGLUTINATION TESTS.—Blood samples for agglutination tests were obtained from all the animals at frequent intervals during the course of the experiment. The tests were carried out by the technique described by Stableforth (1936) using antigen kindly supplied by the Laboratory of the Ministry of Agriculture. The end point of the titre recorded was the highest dilution of serum which produced visible agglutination.

EXAMINATION AT PARTURITION.—At parturition the following materials were obtained for examination:—

(*a*) *Blood.* Samples were taken from the jugular vein.

(*b*) *Cotyledons.* A cotyledon was detached from the foetal membranes as aseptically as possible, preferably before the membranes had been expelled from the animal, and transferred to a sterile McCartney bottle.

(*c*) *Colostrum.* The udder was washed, dried and the teats swabbed with 50 per cent. alcohol. The first three jets from each quarter were discarded. Thereafter, a McCartney bottle was filled with approximately 5 ml. from each quarter.

(*d*) *Foetal Stomach Contents.* The abdomen of the foetus was incised, the surface of the stomach wall seared with a hot spatula and a sample of the contents transferred to a McCartney bottle by means of a Pasteur pipette.

The samples from the vaccinated animals were examined culturally and biologically, whereas samples from the controls were examined biologically only if a culture of *Brucella* was not obtained.

CULTURAL TECHNIQUE.—Plates of bacto-tryptose agar containing 2½ per cent. blood were inoculated respectively with varying quantities of gravity cream from colostrum, with a 20 per cent. suspension of pulped cotyledon in Ringer's fluid and with foetal stomach contents. In no case did the inocula exceed 0·5 ml. of the colostrum and 0·1 ml. of cotyledon suspension or foetal stomach contents. The plates were incubated aerobically and in 10 per cent. CO_2 at 37° C. for four days.

BIOLOGICAL TESTS.—Five guinea-pigs were used for each sample of material from the vaccinated animals and two for each sample from the controls. The dose consisted of 1·0 ml. injected intramuscularly. One pig of the vaccinated group was killed eight days after injection and the remainder six weeks after injection.

EXAMINATION OF MILK SAMPLES.—*Post-partum* milk samples from all animals were examined weekly for ten weeks. Those from vaccinated animals were tested culturally and biologically, whereas samples from controls were examined biologically only if no culture of Brucella was obtained. The inoculum for biological tests was 1·0 ml. gravity cream injected intramuscularly.

IDENTIFICATION OF *Br. abortus*.—Films were made from suspected colonies and slide agglutination tests prepared. If the organism resembled *Br. abortus* morphologically and serologically, it was accepted as *Br. abortus*.

Throughout the experiment all samples for cultural examination were taken in triplicate and each of the three samples was examined by a different worker. Occasionally *Br. abortus* was isolated from a particular site by one worker only and in such cases a positive result was recorded.

Results

VACCINATION.—Swellings of varying degree up to 6 in. in diameter developed at the site of vaccination and some animals showed slight constitutional disturbance which passed off in 48 hours. In one animal the swelling became indurated and persisted for the duration of the experiment.

FERTILITY RATE.—With one exception (E.2), all of the 20 vaccinated animals became pregnant, while of the 30 non-vaccinated, three were infertile. There was therefore, no evidence that the vaccine had lowered the fertility rate in the vaccinated as compared with the non-vaccinated animals. Prior to application of the infective dose the three non-vaccinated barren animals, one in unit A and two in unit B, were exchanged for three of the non-vaccinated pregnant animals in unit C.

UNIT C.—*Non-vaccinated, non-infected Controls.* The heifers in unit C were examined regularly throughout the course of the experiment by the same methods as those adopted for animals in the other groups. All remained negative to the agglutination test and at parturition all were free from infection. In the eighth month of pregnancy, one aborted from a non-specific cause; no

TABLE I

SMALL INFECTIVE DOSE—CONTROLS (UNVACCINATED)

13.4.43 small infective dose, 15 million viable organisms *Br. abortus* Strain 544, applied to the conjunctiva

Heifer No.	Agglutination titres of serum: Weeks before infection 35	33	31	28	26	23	19	14	9	7	5	2	13.4.43 0	Weeks after exposure to infection 2	5	8	11	14	17	20	23	26	29	32	History of pregnancy: Days from service to infection	Days from infection to parturition	Duration of pregnancy in days	Parturition	Fate of calf	At parturition: Blood serum titre	Cotyledons Cult.	Cotyledons Biol.	Colostrum Cult.	Colostrum Biol.	Foetal stomach Cult.	Foetal stomach Biol.
A1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2	4	4	7	8	8	10	8	10	..	165	100	265	PI	L	7	+	..	—	0/2	..	..
A2	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	4	8	8	8	6	6	..	156	106	262	PI	L	6	+	..	—	0/2	..	..
A3	–	–	–	–	–	–	–	–	–	–	–	–	–	1	3	3	3	2	5	8	8	6	6	..	151	116	267	PI	D	5	+	..	—	2/2	+	..
A4	–	–	–	–	–	–	–	–	–	–	–	–	1	2	3	5	7	8	9	8	9	7	9	..	146	82	228	PI	D	7	+	..	+	..	+	..
A5	–	–	–	–	–	1	–	–	–	–	–	–	–	–	3	2	4	5	7	6	9	8	9	..	141	133	274	NI	L	7	+	..	+	..	..	..
A6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	5	8	11	10	10	8	11	..	152	104	256	PI	D	9	+	..	+	..	+	..
A7	–	–	–	1	–	–	–	–	–	–	–	–	–	3	3	7	7	7	7	6	6	5	7	..	156	59	215	PI	D	7	+	..	+	..	+	..
A8	–	–	–	–	–	–	–	–	–	–	–	–	–	1	3	6	8	10	10	10	10	9	12	..	152	71	223	PI	D	7	+	..	+	..	+	..
A9	–	–	–	–	–	–	–	–	–	1	–	–	–	–	3	2	7	10	9	11	11	9	12	..	112	116	228	PI	D	9	+	..	+	..	+	..
A10	–	–	–	–	–	–	–	–	–	–	–	–	Died of anthrax 6.4.43																								

SMALL INFECTIVE DOSE—VACCINATED GROUP

13.8.42 injected subcutaneously with 5·0 ml. Ministry of Agriculture No. 1 Vaccine (*Br. abortus*, Strain 19). 13.4.43 same infective dose as controls above

	Weeks after vaccination 0	2	4	7	9	12	16	21	26	28	30	13.4.43 33	35	Weeks after exposure to infection 2	5	8	11	14	17	20	23	26	29	32												
E1	–	6	5	4	4	3	3	3	2	..	4	3	3	4	5	5	4	4	4	4	4	3	2	2	143	135	278	N	L	4	—	0/5	—	0/5	..	..
Not pregnant:																																				
E2	–	3	6	6	4	4	4	2	2	..	2	2	2	3	3	3	3	3	2	2	2	2	1	1												
E3	–	8	7	6	5	4	4	3	4	..	3	3	3	4	4	4	4	4	3	3	3	3	2	3	149	127	276	N	L	4	—	0/2	—	0/5	..	..
E4	–	7	8	7	6	5	5	4	5	..	4	4	4	6	6	6	6	6	6	5	5	5	4	4	164	124	288	N	L	6	—	0/5	—	0/5	..	..
E5	–	7	6	5	6	4	2	3	3	..	2	2	2	4	4	3	3	3	4	6	4	4	3		132	141	273	NI	L	4	—	5/5	—	3/5	..	..
E6	–	6	5	6	4	3	4	2	1	..	1	1	1	2	2	2	2	2	1	1	1	1	—	–	143	141	284	N	L	1	—	0/5	—	0/5	..	..
E7	–	3	6	6	6	7	6	6	..	..	5	5	5	6	6	6	5	5	4	4	4	4	3	4	146	135	281	N	L	4	—	0/5	—	0/5	..	..
E8	–	8	7	6	5	5	5	3	3	..	3	2	2	3	3	3	3	3	3	2	3	3	2	2	156	121	277	N	L	3	—	0/5	—	0/5	..	..
E9	–	7	7	6	4	4	5	3	3	..	3	3	3	4	4	4	4	3	3	3	3	2	2	2	116	162	278	N	L	3	—	0/5	—	0/5	..	..
E10	1	8	7	6	5	3	4	3	–	..	3	3	3	4	4	6	6	5	5	5	5	5	4	4	132	150	282	N	L	5	—	0/5	—	0/5	..	..

TABLE III

LARGE INFECTIVE DOSE—CONTROLS (UNVACCINATED)

13.4.43 large infective dose, 150 million viable organisms *Br. abortus* Strain 544, applied to the conjunctiva

Heifer No.	Agglutination titres of serum: Weeks before infection 35	33	31	28	26	23	19	14	9	7	5	2	13.4.43 0	Weeks after exposure to infection 2	5	8	11	14	17	20	23	26	29	32	35	38	41	44	History of Pregnancy: Days from service to infection	Days from infection to parturition	Duration of pregnancy in days	Parturition	Fate of calf	At parturition: Blood serum titre	Cotyledons Cult.	Cotyledons Biol.	Colostrum Cult.	Colostrum Biol.	Foetal stomach Cult.	Foetal stomach Biol.
B1	–	–	–	–	–	–	–	–	–	–	–	–	–	3	4	3	7	9	9	8	8	..	..	..	..	..	..	..	112	91	203	PI	D	8	+	..	+	..	+	..
B2	–	–	–	–	–	–	–	–	–	–	–	–	–	3	5	6	7	9	8	6	6	..	..	..	..	..	..	..	156	73	229	PI	D	6	+	..	—	0/2	—	2/2
B3	–	–	–	–	–	–	–	–	–	–	–	–	–	2	3	7	7	9	9	7	8	..	..	..	..	..	..	..	172	71	243	PI	D	6	+	..	+	..	+	..
B4	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	7	10	11	11	9	10	..	..	..	..	..	..	..	138	73	211	PI	D	9	+	..	+	..	+	..
B5	–	–	–	–	–	–	–	–	–	–	–	–	–	3	5	9	10	9	10	9	10	..	..	..	..	..	..	..	169	61	230	PI	D	9	+	..	+	..	+	..
B6	–	–	–	–	–	–	–	–	–	–	–	–	–	3	5	7	8	9	8	7	8	..	..	..	..	..	..	..	115	77	192	PI	D	8	+	..	+	..	+	..
B7	–	–	–	–	–	–	–	–	–	–	1	1	2	3	3	6	7	6	5	3	..	..	..	..	..	..	..	..	176	87	263	PI	L	7	+	..	—	0/2	..	..
B8	–	–	–	–	–	1	1	–	–	–	–	–	–	3	5	8	9	9	9	9	9	..	..	..	..	..	..	..	143	68	211	PI	D	8	+	..	+	..	+	..
B9	–	–	–	–	2	–	–	–	–	–	–	–	–	4	7	8	9	10	8	8	8	..	..	..	..	..	..	..	172	65	237	PI	D	8	+	..	+	..	+	..
B10	–	–	–	–	–	–	–	–	–	–	–	–	–	4	5	7	7	7	7	7	7	..	..	..	..	..	..	..	177	40	217	PI	D	5	+	..	—	2/2	+	..

LARGE INFECTIVE DOSE—VACCINATED GROUP

13.8.42 injected subcutaneously with 5·0 ml. Ministry of Agriculture No. 1 vaccine (*Br. abortus*, Strain 19). 13.4.43 same infective dose as controls above

	Weeks after vaccination 0	2	4	7	9	12	16	21	26	28	30	13.4.43 33	35	Weeks after exposure to infection 2	5	8	11	14	17	20	23	26	29	32	35	38	41	44												
D1	–	7	7	6	5	2	3	2	3	..	2	2	2	4	7	7	5	4	4	3	4	3	2	2	2	2	2	2	145	139	284	N	L	4	—	0/5	—	0/5	..	..
D2	–	6	6	4	4	3	2	3	3	..	3	2	2	4	4	4	4	4	3	2	3	3	2	3	3	3	3	3	48	234	282	N	L	2	—	0/5	—	0/5	..	..
D3	–	6	5	5	3	3	2	2	2	..	1	1	1	2	2	3	3	2	1	1	1	2	1	1	1	1	1	1	103	185	288	N	L	1	—	0/5	—	0/5	..	..
D4	–	8	6	6	5	4	3	3	2	..	3	2	3	4	4	2	3	3	3	3	4	2	3	3	3	3	3	2	153	134	287	N	L	3	—	0/5	—	0/5	..	..
D5	–	7	6	6	6	4	5	4	3	..	3	2	3	3	4	4	3	3	2	2	2	2	2	2	2	2	2	2	48	240	288	N	L	1	—	0/5	—	0/5	..	..
D6	–	8	7	4	6	5	4	4	3	..	3	3	3	7	7	8	9	9	9	9	9	9	8	7	7	6	6	6	124	87	211	PI	D	9	+	5/5	+	0/5	+	0/5
D7	–	5	5	4	4	4	5	4	2	..	2	1	1	3	3	3	2	2	1	–	–	–	–	–	–	–	–	–	122	157	279	N	L	–	—	0/5	—	0/5	..	..
D8	–	7	6	5	3	2	2	2	2	..	1	1	1	2	3	3	5	6	7	8	9	11	12	11	12	9	9	9	100	175	275	NI	L	10	+	5/5	+	4/4	..	..
D9	–	8	7	7	5	6	8	7	8	..	7	7	6	7	6	5	5	5	4	4	4	5	4	4	5	4	4	4	130	153	283	N	L	4	—	0/5	—	0/5	..	..
D10	–	7	7	6	4	5	4	3	3	..	2	3	3	7	4	4	3	2	3	3	4	3	2	2	.2	2	3	3	131	110	241	PN-I	D	3	—	0/5	—	0/5	—	0/5

Agglutination tests, serum dilutions 1 = 1/10, 2 = 1/20, 3 = 1/40, 4 = 1/80, 5 = 1/160, 6 = 1/320, 7 = 1/640, 8 = 1/1,280, 9 = 1/2,560, 10 = 1/5,120, 11 = 1/10,240, 12 = 1/20,480. .. = not done. — = negative. + = positive. Cult. = Bacteriological examination. Biol. = Biological test, No. of guinea-pigs infected/No. used. P = premature. I = infected. N-I = Non-infected. N = Normal. L = Live. D = Dead.

agglutinins for *Br. abortus* were detectable in the blood and the cotyledons, and the foetal stomach and colostrum were proved to be free from infection by cultural and biological tests. It may, therefore, be concluded that the routine precautions taken to prevent the spread of infection between the units within the compound were adequate.

Units A and E. *Effect, on non-vaccinated control and vaccinated animals, of exposure to the Small Infective Dose* (15 *million viable organisms.*)

The history of each animal is shown in detail in Tables I and II.

Animal A10 died of anthrax on 6.4.43 and E2 was barren; thus, for the purpose of the experiment, the effective number of animals on the small test dose was reduced to nine controls and nine vaccinated.

Agglutination Titres.—Table I shows that, apart from four occasions when titres of 1 in 10 were recorded, the control animals were negative to 13 agglutination tests during a period of 35 weeks prior to infection. A similar series of tests in the vaccinated animals showed that, following vaccination, maximum titres ranging from 1 in 320 to 1 in 1,280, with a median of 1 in 640 developed in about two to four weeks. Thereafter, the titres fell gradually until, at 35 weeks after vaccination, when the infective dose was applied, they ranged from 1 in 10 to 1 in 160 with a median of 1 in 40. Following exposure to infection the vaccinated animals developed a rise in titre and, excluding E5 which developed an active infection, maximum titres of 1 in 20 to 1 in 320, with a median of 1 in 120 developed in two to eight weeks. In the controls the rise in titres after infection was more gradual but reached a higher level than in the vaccinated animals and maximum titres of 1 in 640 to 1 in 20,480 with a median of 1 in 2,560 were reached in eight to twenty-nine weeks.

Infection Rate.—Of the nine control animals all developed infection. *Br. abortus* was recovered from the cotyledons of nine out of nine cows; from the colostrum of seven and from the contents of the foetal stomach in six out of six dead calves. Of the nine vaccinated animals, only one, E5, developed an active infection. The causal organism was not recovered by direct culture from this animal, but the cotyledons and colostrum were found to be infected by biological test.

History of Pregnancy.—The duration of pregnancy in the controls ranged from 215 to 274 days with a mean of 246 days, while the range in the vaccinated group was 273 to 288 days with a mean of 280 days. Eight of the nine controls calved prematurely; six of the calves were dead and three survived, whereas the nine vaccinated animals calved normally and produced nine living calves.

Infection Rate in Milk.—*Br. abortus* was recovered from 70 out of 90 milk samples from control cows, but was not detected in any of the 90 samples from vaccinated cows (see Table II).

Units B and D. *Effect, on non-vaccinated control and vaccinated animals, of exposure to the Large Infective Dose* (150 *million viable organisms*).

The history of each animal is shown in detail in Tables III and IV.

Table II

Small Infective Dose—Controls (Unvaccinated)

Heifer No.	Post-partum milk samples examined at weekly intervals for *Br. abortus*																				Milk samples examined	
	1		2		3		4		5		6		7		8		9		10			
	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Total	No. Infected
A1	+	..	—	0/2	+	..	+	..	+	..	+	..	+	..	+	..	+	..	+	..	10	9
A2	—	0/2	+	..	—	2/2	+	..	—	0/2	+	..	—	0/2	+	..	—	0/2	—	0/2	10	5
A3	—	0/2	+	..	—	2/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	2
A4.	+	..	+	..	+	..	—	2/2	+	..	+	..	—	2/2	—	0/2	+	..	+	..	10	9
A5	+	..	+	..	+	..	+	..	+	..	+	..	+	..	+	..	+	..	+	..	10	10
A6	+	..	+	..	+	..	—	2/2	—	1/2	+	..	—	1/2	+	..	+	..	—	1/2	10	10
A7	+	..	—	1/2	+	..	+	..	+	..	—	0/2	—	0/1	—	0/2	—	0/2	—	0/2	10	5
A8	+	..	+	..	+	..	+	..	+	..	+	..	+	..	—	2/2	+	..	+	..	10	10
A9	+	..	+	..	+	..	—	2/2	+	..	+	..	+	..	+	..	+	..	+	..	10	10
A10	Died of anthrax 6.4.43																					
																					90	70

Small Infective Dose—Vaccinated Group

E1	—	0/2	—	0/2	—	0/2	—	0/2	—	0/1	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	0
E2	Not pregnant																					
E3	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/1	—	0/2	—	0/2	10	0
E4	—	0/2	—	0/1	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/1	—	0/2	10	0
E5	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/1	—	0/2	—	0/2	10	0
E6	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/1	—	0/2	—	0/1	—	0/2	—	0/2	10	0
E7	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/1	—	0/2	10	0
E8	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	0
E9	—	0/2	—	0/2	—	0/2	—	0/2	—	0/1	—	0/1	—	0/1	—	0/2	—	0/2	—	0/1	10	0
E10	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/1	10	0
																					90	0

Table IV

Large Infective Dose—Controls (Unvaccinated)

Heifer No.	Post-partum milk samples examined at weekly intervals for *Br. abortus*																				Milk samples examined	
	1		2		3		4		5		6		7		8		9		10			
	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Total	No. infected
B1	+	..	—	1/2	—	0/2	—	0/2	—	0/2	—	0/2	—	2/2	—	0/2	—	0/2	+	..	10	4
B2	—	1/2	—	0/2	+	..	+	..	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	3
B3	+	..	—	2/2	+	..	—	0/2	—	..	—	0/2	—	0/2	—	1/2	—	0/2	—	1/2	10	5
B4	+	..	—	0/2	—	2/2	—	1/1	+	..	—	0/2	—	0/2	—	0/2	—	..	—	0/2	10	4
B5	+	..	—	0/2	+	..	+	..	+	..	+	..	+	..	+	..	+	..	+	..	10	9
B6	+	..	—	1/2	—	0/2	+	..	—	0/2	—	1/2	—	0/1	—	0/2	—	2/2	—	0/2	10	5
B7	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	1/2	—	0/2	10	1
B8	+	..	+	..	+	..	+	..	+	..	+	..	+	..	+	..	+	..	—	0/2	10	9
B9	+	..	+	..	+	..	—	2/2	+	..	—	0/2	—	0/2	—	1/2	—	1/2	—	0/2	10	7
B10	+	..	+	..	+	..	+	..	+	..	+	..	+	..	+	..	—	0/2	—	0/2	10	8
																					100	55

Large Infective Dose—Vaccinated Group

D1	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	0
D2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	0
D3	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	0
D4	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	0
D5	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	0
D6	—	0/2	—	2/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	1
D7	—	0/2	—	0/2	—	0/2	—	0/1	—	0/1	—	0/2	—	0/2	—	0/1	—	0/2	—	0/2	10	0
D8	+	2/2	—	0/2	—	0/2	+	2/2	+	2/2	+	2/2	+	2/2	+	2/2	+	1/2	+	2/2	10	8
D9	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	—	0/1	—	0/2	—	0/2	—	0/2	10	0
D10	—	0/2	—	0/2	—	0/2	—	0/2	—	0/1	—	0/2	—	0/2	—	0/2	—	0/2	—	0/2	10	0
																					100	9

Agglutination tests, serum dilutions 1 = 1/10, 2 = 1/20, 3 = 1/40, 4 = 1/80, 5 = 1/160, 6 = 1/320, 7 = 1/640, 8 = 1/1,280, 9 = 1/2,560, 10 = 1/5,120, 11 = 1/10,240, 12 = 1/20,480. · = not done. — = negative. + = positive. Cult. = Bacteriological examination. Biol. = Biological test. No. of guinea-pigs infected/No. used. P = premature. I = infected. N-I = Non-infected. N = Normal. L = Live. D = Dead.

Agglutination Titres.—Table III shows that apart from five occasions when low titres were recorded, the control animals were negative to 13 agglutination tests during a period of 35 weeks prior to infection. A similar series of tests in the vaccinated animals showed that all were positive two weeks after vaccination and, the maximum titres developed ranged from 1 in 160 to 1 in 1,280 with a median of 1 in 640. When the infective dose was applied the titres ranged from 1 in 10 to 1 in 320 with a median of 1 in 30. After applying the test dose the controls developed maximum titres in eight to 14 weeks ranging from 1 in 640 to 1 in 10,240 with a median of 1 in 2,560, while in the vaccinated group the maximum titres ranged from 1 in 40 to 1 in 20,480 with a median of 1 in 240.

Infection Rate.—All of the ten control animals developed infection. *Br. abortus* was recovered from the cotyledons of ten out of ten cows; from the colostrum of eight and from the contents of the foetal stomach in nine out of nine dead calves. Of the ten vaccinated animals, D10 aborted from a non-specific cause. Two animals, D6 and D8, developed an active infection and *Br. abortus* was isolated by direct culture from the cotyledons and colostrum of both. D6 had a premature dead calf and the contents of the foetal stomach were infected.

History of Pregnancy.—The duration of pregnancy in the controls ranged from 192 days to 263 days with a mean of 224 days, while in the vaccinated group (excluding D10) the range was 211 to 288 days with a mean of 275 days. All of the ten control animals calved prematurely, nine of the calves were dead and one survived, whereas in the vaccinated group (excluding D10) one animal only, D6, produced a premature dead calf, and the remaining eight had full-term living calves.

Infection Rate in Milk.—*Post-partum* milk samples examined weekly for ten weeks showed the presence of *Br. abortus* in 55 out of 100 samples from control animals and 9 out of 100 samples from vaccinated animals. Of the nine positive samples, eight were from the same animal, D8, and one from D6. Both of these animals failed to resist infection. (See Table IV.)

Character of Strains Recovered from Vaccinated Animals.—The strains isolated from vaccinated animals were all CO, sensitive and in that respect they resembled the infecting strain 544. Nine hundred and twenty-nine colonies of *Br. abortus* obtained by direct culture, from the two vaccinated animals, D6 and D8, that failed to resist infection, were examined for their sensitivity to the bacteriostatic action of thionine blue by the method described by McLeod (1944) and all were capable of growth on a medium containing a concentration of thionine blue which inhibited the growth of strain 19. Further, of 558 guinea-pigs used for the biological tests of material from all the vaccinated animals, 39 inoculated with material from the three vaccinated animals, D6, D8 and E5, developed infection. The disease in these guinea-pigs was typical of that produced by a fully virulent strain, with enlargement and heavy infection of the spleen six weeks after injection.

For convenience of interpretation the experiment is summarized in Table V.

nated animals. Attempts have been made to eliminate this danger by the use of vaccines prepared from strains of reduced virulence, which are less liable to cause persistent infection in the animal body. Prominent amongst these is strain 45/20 (McEwen, 1937 to 1946) which has been extensively used in this country and issued until recently by the Ministry of Agriculture as abortion vaccine No. 2, and strain 19 (Buck, 1930) used extensively in the United States (Huddleson, 1942), (Crawford, 1944), and issued in this country by the Ministry of Agriculture as abortion vaccine No. 1.

In selecting one of a number of avirulent strains for immunization of cattle on a nation-wide scale it is, in the first place, desirable to choose the strain that produces the best immunity and which, at the same time, is least likely to cause a persistent infection. In the second place, in the interests of safeguarding public health preference would be given to the strain in which the character of reduced virulence is most stable. It is appropriate, therefore, to compare the evidence so far obtained regarding the virulence, stability and immunizing properties of strain 19 and strain 45/20.

In the guinea-pig, de Ropp (1945) showed that strain 45/20 is more virulent since it persists in the spleen for a period up to 12 weeks, whereas strain 19 is eliminated in less than six weeks. He also found that vaccines prepared from strain 19 produced a better immunity in guinea-pigs than vaccines prepared from 45/20. Stableforth (1945) has also reported that in guinea-pigs strain 19 gives a significantly higher protection than strain 45/20.

In the bovine, McEwen (1940) found that strain 45/20, which is a serologically rough type, caused abortion and reverted to a smooth virulent form when injected into animals well advanced in pregnancy. A susceptible pregnant animal which was in contact aborted and an aerobic strain of *Br. abortus*, believed to be derived from the vaccine strain, was isolated from the foetus and the milk. This enhancement of virulence was also observed by passage of the strain through guinea-pigs. When non-pregnant cattle were inoculated with strain 45/20, however, McEwen (1940a, 1940b and 1946) found no evidence of the persistence of the organism, whereas Edwards, de Ropp and McLeod (1945) could not exclude the possibility that the vaccine strain might become enhanced in virulence and persist for long periods in the animal body.

Mingle, Manthei and Jasmin (1941) passaged strain 19 through a series of guinea-pigs without causing any change in its original character. Extending these investigations still further, they found it possible by injection of large doses intravenously, to induce abortion in pregnant cattle with strain 19, but no evidence of spread of infection to susceptible cattle kept in contact was obtained. Brucella cultures recovered from aborted foetuses were injected in series into pregnant cattle for seven generations. Critical comparison of the cultures recovered at successive generations revealed no detectable changes either in virulence or other characters. Further evidence of the stability of the character of reduced virulence after passage through the pregnant cow has been presented by Birch, Gilman and Stone (1943).

Table V

Strain 19 Vaccine

Summary of Important Points of Difference between Vaccinated and Control cattle exposed during Pregnancy to Infection with *Brucella abortus*, Strain 544

Infective dose applied 35 weeks after vaccination

		Range and median of maximum agglutination titres for 35 weeks after vaccination and prior to infection	Range and median of agglutination titres at the time of applying infection	Range and median of maximum agglutination titres after applying infection	Range and mean duration of pregnancy in days	Number of animals which developed infection	Number of living calves per pregnant females	Number of milk samples with *Br. abortus* during 10 weeks after parturition
Small infective dose ..	Vaccinated	1/320 to 1/1,280 Median 1/640	1/10 to 1/160 Median 1/40	1/20 to 1/320 Median 1/120	273 to 288 Mean 280	1 out of 9	9 out of 9	0 out of 90
15 million viable organisms	Controls	0 to 1/10	0 to 1/10	1/640 to 1/20,480 Median 1/2,560	215 to 274 Mean 246	9 out of 9	3 out of 9	70 out of 90
Large infective dose ..	Vaccinated	1/160 to 1/1,280 Median 1/640	1/10 to 1/320 Median 1/30	1/40 to 1/20,480 Median 1/240	211 to 288* Mean 275	2 out of 10	8 out of 9	9 out of 100
150 million viable organisms	Controls	0 to 1/20	0 to 1/10	1/640 to 1/10,240 Median 1/2,560	192 to 263 Mean 224	10 out of 10	1 out of 10	55 out of 100

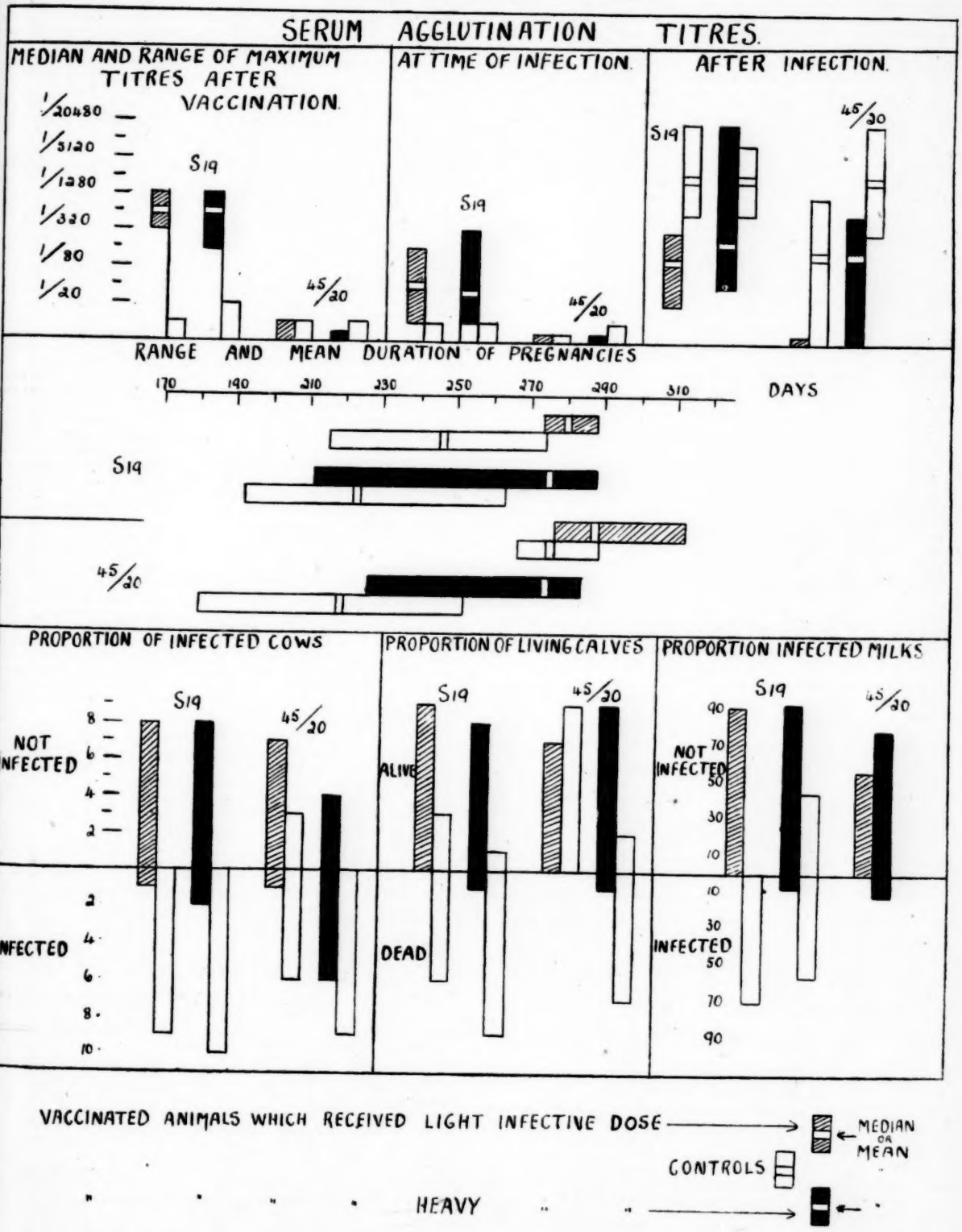
* Excludes D10 which aborted from a cause other than infection with *Br. abortus*.

Comparison of virulence and immunological properties of Strain 19 and Strain 45/20

It is generally accepted that the incidence of contagious abortion in cattle can be reduced by the use of vaccines containing living *Br. abortus*. When such vaccines contain fully virulent organisms, however, there is always the risk of establishing a persistent infection in the animal body and especially in the udder. There has been objection, therefore, to the use of virulent living vaccines in non-infected herds because of the danger of spreading the infective agent and the risk of infecting the consumer of milk from vacci-

A comparison of the agglutination response and immunity produced in cattle by means of the two vaccines is set out in the accompanying diagram. This has been prepared from the data in the present paper relating to S 19 and from the paper by Edwards *et al.*, relating to 45/20. In making this comparison, attention is directed to the following differences in the two experiments. Firstly, the cattle vaccinated with 45/20 received two doses, each of 8·0 ml. at a month's interval, representing 240,000 million organisms, whereas those vaccinated with S 19 received a single dose of 60,000 million organisms. Thus the 45/20 group had the

COMPARISON OF REACTION IN CATTLE VACCINATED WITH S19 AND 45/20 WHEN EXPOSED TO INFECTION ALONG WITH CONTROLS.



benefit of a double stimulus with four times the number of organisms given to the S 19 groups as a single stimulus. Secondly, while the large infective dose employed to test immunity was the same in both experiments, the small infective dose used to test immunity in the S 19 group was ten times greater than that used to test the comparable group in the 45/20 experiment. Despite these disadvantages, it will be seen from the diagram that the immunity produced by S 19 vaccine was superior to that produced by 45/20 and when this evidence is considered in conjunction with the results obtained by de Ropp and by Stableforth in guinea-pigs, it leaves little doubt that S 19 is the better immunizing agent.

Although 45/20 possesses the advantage that it can be injected into non-pregnant cattle without producing agglutinins, the evidence outlined above indicates that it is a more virulent organism, that its character of reduced virulence is less stable and its immunizing power poorer than strain 19.

Conclusion

As a result of this experiment it may be concluded that a vaccine prepared from *Br. abortus*, strain 19, confers a substantial degree of immunity in cattle against a virulent infection applied 35 weeks after vaccination.

No evidence of the establishment of a persistent infection from the vaccine strain was obtained.

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The Transference of Agglutinins for Brucella Abortus from Cow to Calf and their Persistence in the Calf's Blood

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It has been shown that all calves are born without agglutinins for *Br. abortus*, regardless of the reaction of their dams (McAlpine and Rettgar, 1925) but that such agglutinins are almost invariably demonstrable after calves have fed on the colostrum of infected cows (Little and Orcutt, 1922) and disappear within a period of six months (Thorp and Graham, 1933).

In this paper further evidence is presented regarding the interval between the ingestion of colostrum and the detection of agglutinins in the blood of the calf, and the curve determining the disappearance of these agglutinins has been established.

Technique

Animals Employed.—Sixteen Ayrshire and Friesian heifers, which were being used to test the immunizing value of S.19 vaccine (Edwards, McDiarmid, de Ropp and McLeod, 1946) were employed, 12 of the heifers had been vaccinated and all had been exposed to a virulent infection during pregnancy. The individual histories are shown in Table I.

Methods of Obtaining Samples

(*a*) *Colostrum.*—The udder was washed, dried and the teats swabbed with 50 per cent. alcohol. The first three jets of milk from each quarter were discarded. Thereafter a sterile McCartney bottle was filled with approximately 5 ml. of milk from each quarter. The samples were retained in the cold store until examined.

(*b*) *Milk.*—The samples were obtained in the same manner as above except that the udder was practically milked out prior to withdrawing the samples.

(*c*) *Blood.*—Samples were taken from the jugular vein.

Cultural Examination of the Milk and Colostrum.—0·5 ml. of milk or colostrum was spread on the surface of a freshly prepared 2½ per cent. ox blood bacto-tryptose agar plate. The plate was incubated in 10 per cent. CO_2 for five days at 37° C.

Identification of *Br. abortus*.—A film was made from the suspected colony and stained for a few seconds with undiluted carbol fuchsin. A slide agglutination test was also prepared. If the organisms resembled *Br. abortus* culturally, morphologically and the agglutination test proved positive, the colony was accepted as *Br. abortus*.

Agglutination Test.—Colostrum and milk samples were treated with rennet and the resultant whey was centrifuged to obtain a clear fluid for the agglutination test. The blood samples were kept at room temperature overnight, then centrifuged and the sera and whey tested by the technique described by Stableforth (1936) using normal saline for preparing the dilutions and the standard antigen kindly supplied by the Ministry of Agriculture Laboratory, Weybridge. Readings were taken after overnight incubation at 37° C., the titre recorded being the highest dilution of serum or whey which produced visible agglutination.

Experimental

At birth, the calf was prevented from sucking until the following samples had been obtained:—

1. Blood from dam for agglutination test.
2. Blood from calf for agglutination test.
3. Colostrum from dam for cultural examination and whey agglutination test.

Table I
Individual Histories

No. of Heifer	Breed	Service date	Infected with *Br. abortus*, 13.4.43	Date of parturition	Gestation period	Parturition	Description of calf
Infected Control Group							
A1	B.F.	30.10.42	15 million virulent organisms (Strain 544)	22.7.43	265	Premature +	Apparently normal (M.)
A2	A.	8.11.42	" " (")	28.7.43	262	" +	" " (M.)
A5	A.	23.11.42	" " (")	24.8.43	274	Normal +	" " (F.)
B7	A.	19.10.42	150 million virulent organisms (Strain 544)	9.7.43	263	Premature +	Very weak, unable to suck unaided (F.)
Vaccinated Group•							
D3	A.	31.12.42	150 million virulent organisms (Strain 544)	15.10.43	288	Normal	Normal (M.)
D4	A.	11.11.42	" " (")	25.8.43	287	"	" (M.)
D5	A.	24.2.43	" " (")	9.12.43	288	"	" (M.)
D7	A.	12.12.42	" " (")	17.9.43	279	"	" (F.)
D8	A.	3.1.43	" " (")	5.10.43	275	" +	Apparently normal (F.)
D9	B.F.	4.12.42	" " (")	13.9.43	283	"	Normal (M.)
E1	A.	21.11.42	15 million virulent organisms (Strain 544)	26.8.43	278	"	" (M.)
E3	A.	15.11.42	" " (")	18.8.43	276	"	" (F.)
E4	A.	31.10.42	" " (")	15.8.43	288	"	" (M.)
E7	B.F.	18.11.42	" " (")	26.8.43	281	"	" (M.)
E9	A.	18.12.42	" " (")	22.9.43	278	"	" (F.)
E10	A.	2.12.42	" " (")	10.9.43	282	"	" (F.)

B.F. signifies British Friesian.
A. " Ayrshire.
\+ " *Br. abortus* isolated from foetal membranes.
• signifies vaccinated subcutaneously with 5 ml. S.19 vaccine 13.8.42.
(M.) " Male.
(F.) " Female.

TABLE II

THE MODE OF TRANSFERENCE OF AGGLUTININS FOR *Brucella abortus* FROM COW TO CALF

Part 1: Agglutination titre of cow at parturition, culture of colostrum, and agglutination titre of whey and cultural examination of milk after parturition (weeks)

No. of cow	Agglutination titre of cow at parturition: Blood	Agglutination titre of cow at parturition: Whey	Culture of colostrum	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12	Wk 13	Wk 14	Wk 15	Wk 16	Wk 17	Wk 18	Wk 19	Wk 20
Infected Control Group																							
A1	7	10	N	+ 4	N 4	+ 4 (8)	+ 4	+ 4	+ 4 (8)	+ 5	+ 5	+ 5 (10)	+ 4	5	5 (8)	5	3	5 (10)	4	5	5	4	
A2	6	11	N	N 6	+ 6 (8)	N 5	+ 5	N 5 (8)	+ 5	N 5	+ 6 (8)	N 6	N 6	6 (6)	4	3	5 (6)	4	4	3	3		
A5	7	10	+	+ 5 (6)	+ 5	+ 4	+ 5 (9)	+ 4	+ 5	+ 6 (8)	+ 5	+ 5	+ 5 (9)	5	5	4	4	3					
B7	7	9	N	N 3	N 2 (7)	N –	N	N (6)	N	N	N (5)	N	N	(3)									
Vaccinated Group																							
D3	1	3	N	N –	N	N (1)	N	N	N (1)	N	N	N (1)	N		(1)			(1)			(1)		
D4	3	5	N	N – (3)	N	N	N (3)	N	N	N (4)	N	N	N (2)			(3)			(3)			(3)	
D5	2	4	N	N – (2)	N	N	N (2)	N	N	N (2)	N	N	N (2)										
D7	–	3	N	N –	N	N (–)	N	N	N (–)	N	N	N (–)	N		(–)			(–)			(–)		
D8	10	11	+	+ 5 (11)	N 5	N 5	+ 4 (12)	+ 6	+ 4	+ 4 (11)	+ 3	+ 4	+ 4 (12)	3	–	(9)			(9)			(9)	
D9	4	9	N	N 1 (4)	N	N	N (4)	N	N	N (4)	N	N	N (5)			(4)			(4)			(5)	
E1	4	5	N	N – (4)	N	N	N (4)	N	N	N (3)	N	N	N (2)			(2)							
E3	4	7	N	N –	N (3)	N	N	N (3)	N	N	N (3)	N	N	(2)			(3)						
E4	6	10	N	N –	N (5)	N	N	N (5)	N	N	N (5)	N	N	(4)			(4)						
E7	4	8	N	N – (4)	N	N	N (4)	N	N	N (5)	N	N	N (3)			(4)							
E9	3	5	N	N –	N	N (2)	N	N	N (2)	N	N	N (2)	N										
E10	5	8	N	N 4	N 2 (5)	N	N	N (5)	N	N	N (4)	N	N	(4)									

Part 2: Interval between birth and sucking, and agglutination titre of the calves' blood

No. of cow	Interval between birth and sucking in hours	Before sucking	After sucking: 5 mins.	10 mins.	15 mins.	1 hr.	2 hrs.	3 hrs.	24 hrs.	48 hrs.	72 hrs.	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12	Wk 13	Wk 14	Wk 15	Wk 16	Wk 17	Wk 18	Wk 19	Wk 20
Infected Control Group																															
A1	1	–	–	–	–	–	3	3	9	8	8	8	7	6	6	3	4	4	4	4	3	3	1	2	1	1	1	1	1	–	
A2	3·5	–	–	–	–	–	3	3	7	7	7	6	6	6	5	4	3	4	3	3	3	2	2	2	2	2	1	1	–		
A5	1	–	–	–	–	–	–	4	8	8	7	6	5	5	6	6	6	4	4	4	3	3	3	2	1	–					
B7	2·5	–	–	–	–	–	S	2	5	5	4	4	3	3	3	3	2	–													
Vaccinated Group																															
D3	6	–	–	–	–	–	–	–	–	–	–	–																			
D4	7	–	–	–	–	–	–	–	1	2	2	–																			
D5	9·5	–	–	–	–	–	–	1	2	2	1	–																			
D7	6	–	–	–	–	–	–	1	2	2	1	–																			
D8	7	–	–	–	–	3	6	8	10	9	9	9	12	10	7	9	8	7	6	5	5	3	1	–							
D9	1	–	–	–	–	–	–	1	2	3	2	2	–																		
E1	11	–	–	–	–	–	–	–	1	–	–	–																			
E3	15·5	–	–	–	–	–	–	1	3	2	2	1	–																		
E4	12	–	–	–	–	–	2	3	4	4	5	3	–																		
E7	6	–	–	–	–	–	–	5	7	6	6	4	3	3	3	3	3	1	–												
E9	10·5	–	–	–	–	–	–	1	3	3	3	1	–																		
E10	6·5	–	–	–	–	–	3	4	6	6	5	4	3	3	2	2	2	2	1	1	–										

N Signifies no *Br. abortus* isolated.
\+ " *Br. abortus* isolated.
– Negative agglutination titre.
S " Sample not obtained.

( ) Signifies Blood agglutination titre of dam.
The agglutination titre is indicated by a number which refers to the last tube in which visible agglutination occurred.
The dilutions of serum were as follows: 1:10, 1:20, 1:40, etc.

FIG. 1.

A 2.

THE TITRE OF THE CALF'S BLOOD AND THAT OF THE WHEY AND BLOOD OF THE DAM.

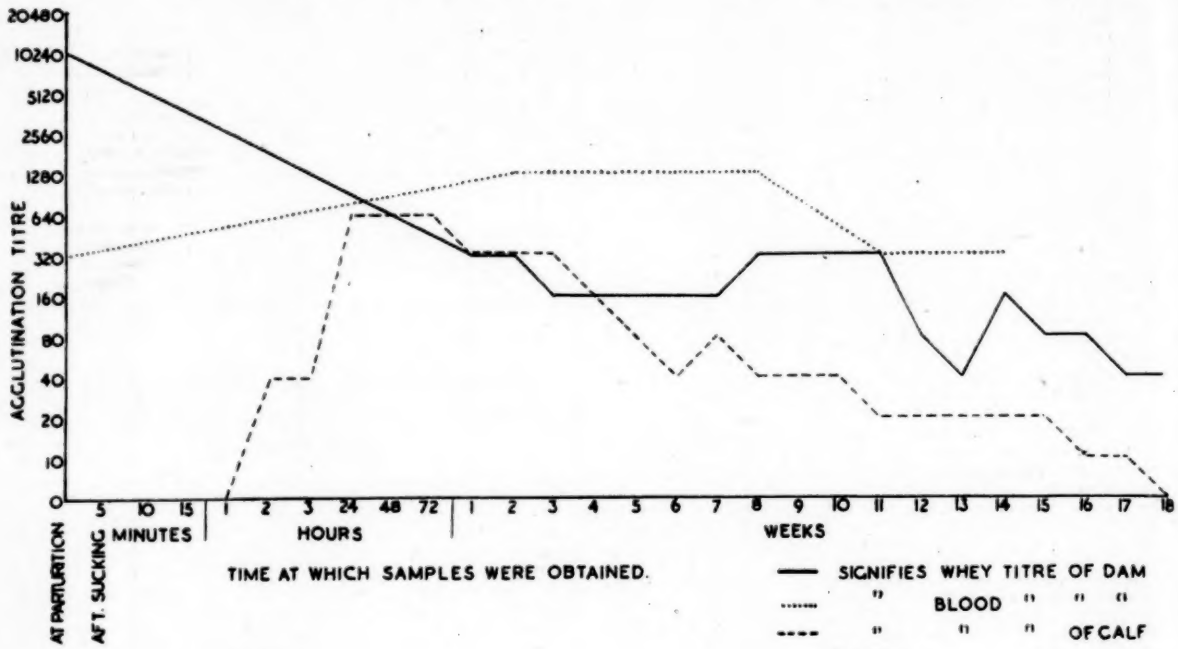


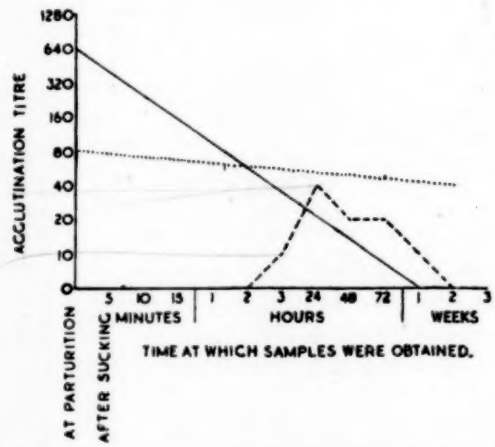
FIG. 2.

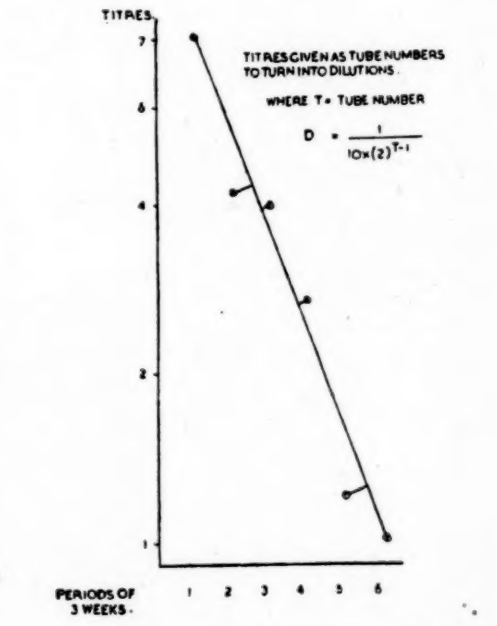
E 3.

FIG. 3.

CURVE FOR DISAPPEARANCE OF AGGLUTININS IN CALF'S BLOOD.

THE TITRE OF THE CALF'S BLOOD AND THAT OF THE WHEY AND BLOOD OF THE DAM.





AVERAGE TITRES FOR 3 WEEK PERIODS ON LOGARITHMIC SCALE. CALF A.1. (LINE DRAWN FREEHAND.)

Thereafter the calf was allowed to take a substantial feed of its own mother's colostrum and, in most cases, blood samples were obtained from the calf at intervals of five, ten and 15 minutes, one, two, three, 24, 48 and 72 hours and then weekly until agglutinins were no longer detectable. After the first blood sample had been obtained, the calf was allowed to suck its own mother at will throughout the course of the experiment. The agglutination titre of the whey from the *post-partum* milk samples of the dam was determined each week until agglutinins were no longer detectable in the calf; the milk was also examined culturally for the presence of *Br. abortus* during the first ten weeks after parturition. In addition, the agglutination titre of the dam's blood was recorded at intervals after calving.

Results

It can be seen from Table II that no agglutinins could be demonstrated in the calf's blood before it had sucked, even when the period between birth and sucking was as long as 15·5 hrs. (E.3).

After the calf had sucked colostrum containing antibody, agglutinins were detectable in its blood in from one to three hours, but a longer period was required when the reaction in the calf was slight.

The disappearance of agglutinins is depicted in Figs. 1 and 2, but owing to the coarse grading of the agglutination dilutions, the curve is too irregular for its shape to be apparent. When the titres for two or three weeks are averaged, however, it can be shown that, with the exception of A.5, the disappearance takes the form of a logarithmic curve; such a curve for calf A.1 is demonstrated in Fig. 3.

DISCUSSION

While it appears obvious that the appearance of agglutinins in the blood of the calf is due to the ingestion of colostrum, the disappearance of these agglutinins may be affected by other factors.

One hypothesis could be that the persistence of the agglutinins in the calf was dependent on the titre of the colostrum, but that in some calves there was a factor interfering with the absorption of the immune bodies. Thus, where the colostrum had a titre as high as ten or eleven, the calf's titre persisted for from 12 to 18 weeks; where the titre was between eight and nine the titre in the calf persisted for six to nine weeks, and where the titre was seven or less the agglutinins could not be demonstrated in the calf's blood in the second week. The two exceptions to this rule (E.4 and D.9) would, with this hypothesis, be accepted as cases in which there was some failure in the absorption of immune bodies.

The persistence of agglutinins in the blood of the calf as compared to the whey of the dam is shown in Figs. 1 and 2. The investigation of a possible correlation between these two titres was weakened by the fact that the estimation of the whey agglutinins was discontinued as soon as the calf's serum became negative. It could be said, however, that where the whey agglutinins were persistent, the sera agglutinins also persisted, but the converse does not hold good, for in Heifer E.7 the whey was negative and yet agglutinins persisted in the calf for seven weeks. There is, therefore, no evidence that the agglutination titre of the calf is dependent on the titre of the dam's milk, as distinct from the colostrum.

The possibility exists that the presence of organisms might affect the persistence of agglutinins in the calf. Where organisms were present both in the colostrum and in the milk (A.5 and D.8) a slight fall occurred in the agglutination titre of the calf, followed by a slight rise, but despite this irregularity the agglutinins disappeared more quickly in these calves than where the organism was absent in the colostrum, hence there is no evidence that the presence of the organisms in the colostrum prolonged the presence of detectable antibody in the calf's blood. Where organisms were present in the milk but not the colostrum (A.1 and A.2) agglutinins persisted in the calf's blood for longer periods than where organisms were absent, but as in each case the colostrum titre was a high one, and as the calf's titre fell regularly in a logarithmic curve from the first week, there was no evidence to show that the presence of organisms in the milk prolonged the presence of detectable antibody in the blood.

The evidence in this experiment, therefore, supports the first hypothesis, that the persistence of agglutinins in the calf's blood is dependent on the titre of the colostrum except where other factors prevent the absorption of immune bodies.

Conclusion

No agglutinins can be demonstrated in the blood of the calf until it has ingested colostrum containing immune bodies; agglutinins then commonly appear in from one to three hours, reach their maximum by 24 hours and then recede as a logarithmic curve over periods varying from days to months; the period of persistence depending to a large extent on the titre of the colostrum.

Acknowledgments.—Thanks are due to Dr. W. S. Gordon, Director of this Field Station, for much helpful advice and criticism and to Dr. H. H. Holman for his assistance in the preparation of this paper.

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CLINICAL COMMUNICATION

So-called "Skin Tuberculosis"

JOHN F. BRADLEY, M.R.C.V.S.,
Fishguard

The following case may prove of interest as a contribution to the slender chain of evidence concerning the condition of nodular subcutaneous lesions in cattle.

History.—I was asked to attend a Cross Jersey cow, belonging to a tuberculin-tested dairy herd. Upon examination I found that the right hind leg, upon which the animal was markedly lame, bore, from the coronet to two-thirds of the way up the external aspect of the leg, a chain of nodular swellings, varying in size from that of a pea to that of half a finger and appearing to follow the course of a lymphatic vessel. The cow herself showed a rather staring coat; the temperature was 103·5° F. The owner explained that the swellings had made their appearance only about three weeks before; the lameness had been insidious in onset and only became definite within the past week. Two months had elapsed since the cow had calved and two months prior to this again she had been classified by the Ministry as negative after retest as a doubtful reactor to the tuberculin test.

Diagnosis.—The swellings varied in consistency, presumably on account of different degrees of inspissation of the contents. A sample withdrawn from one of the softer nodules and revealing thick, creamy pus, was despatched for examination to Mr. D. R. Allen, M.R.C.V.S., of the Veterinary Investigation Department, University College, Cardiff. He replied, stating that the sample showed acid-fast bacilli and expressed his interest in the case. At a second visit he accompanied me, noted the clinical evidence and took another sample for examination, which gave a result identical with the first, showing acid-fast bacilli alone. A sample was then sent to Weybridge for biological examination. The preliminary microscopical examination again confirmed the existence of acid-fast bacilli and intimation was made to me that, should the case be, in fact, one of "skin tuberculosis" it was not anticipated that lesions would be produced in laboratory animals. Three months later I received notification from the laboratory that the biological examinations had been completed and that, at *post-mortem* examination, the guinea-pigs concerned had proved perfectly normal. *Post-mortem* examination of the subject itself at this time was not considered likely to be of benefit nor, in the economic interests of the client, practicable, but an effort is being made to follow the case until the cow is finally slaughtered in order that it may be possible to examine the carcase.

Conclusion.—The earliest investigations on this subject appear to have been done by American workers who have revealed a condition, officially termed "skin tuberculosis," the chief feature of which is thickening, in the form of nodules or cords, of the subcutaneous lymphatic vessels in the region of the shoulder, the tarsus and the fetlocks. The thickenings contain acid-fast rods which seem to cause reaction to tuberculin. Mohler has reported that "a number of so-called skin lesions have been obtained from various sections of the United States in an attempt to culture the organism causing this condition and to transmit it to laboratory animals. All attempts gave negative results." According to Hastings, "the preponderance of evidence collected by a number of workers is against the skin lesions being tuberculous." Hole and Hulse in this country, while not necessarily committing themselves to the view that the acid-fast rods cause tuberculin sensitization, have arrived at similar conclusions.

The distinctive feature about the case recorded as compared with work previously reported, is the marked clinical symptoms accompanying the lesions, *viz.*, elevated temperature, lameness and loss of condition. The last two signs attracted the attention of the client subsequent to the appearance of the nodules. Both Mr. Allen and myself made a thorough clinical examination of the affected animal and were unable to avoid the conclusion that the clinical signs manifested were associated with the nodular swellings.

I should like to state my indebtedness to the encouragement and very able assistance provided by Mr. D. R. Allen and also to the staff of the Veterinary Laboratory, Weybridge.

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NOTES AND NEWS

Diary of Events

Apr. 1st.—R.C.V.S. Annual Fees due.
Apr. 1st.—Meeting of the Farmers' Club at the Royal Empire Society, Craven Street, W.C.1, 2.30 p.m.
Apr. 4th.—Meeting of the Central Veterinary Society at the Conway Hall, Red Lion Square, W.C.1, 2 p.m.
Apr. 4th.—Spring Quarterly Meeting of the Society of Dairy Technology (Welsh Section), at Llandrindod Wells (The Albert Hall), 11 a.m.
Apr. 8th.—Meeting of the Society of Veterinary Practitioners at St. Leonards-on-Sea (Warrior House Hotel), 2 p.m.
Apr. 10th.—Meeting of the Editorial Committee, N.V.M.A., 2.30 p.m.
Apr. 10th.—R.C.V.S. Committee Meetings.
Apr. 11th.—R.C.V.S. Committee Meetings.
Apr. 11th.—Annual Meeting of the West of Scotland Division, N.V.M.A., at Glasgow (North British Station Hotel), 2.30 p.m.
Apr. 12th.—R.C.V.S. Committee and Council Meetings.

N.V.M.A. Meetings at 36, Gordon Square:—

Apr. 15th.—Finance and General Purposes Committee at 11.30 a.m.
Apr. 16th.—Sub-committee on First Aid Handbook at 10 a.m.
Organizing Committee at 12 noon.
Joint Veterinary Officers and Public Health and Parliamentary Committee at 2 p.m.
Appointments Committee at 4 p.m.

N.V.M.A. Meeting at the Connaught Rooms, Great Queen Street:—

Apr. 17th.—Council Meeting at 11 a.m.
Apr. 23rd.—Meeting of the Society of Chemical Industry (Agriculture Group), 2.30 p.m. (Venue to be announced later.)
Apr. 26th.—Meeting of the Mid-West Division, N.V.M.A., at Clifton (Bright's Café), 2.15 p.m.
Apr. 26th.—Meeting of the Royal Counties Division, N.V.M.A., at Oxford (Randolph Hotel), 2.30 p.m.
May 3rd.—Meeting of the Welsh Branch, N.V.M.A., at Aberystwyth.
May 7th.—R.C.V.S. Animal Management Examinations, commencing in London.
May 7th.—R.C.V.S. Council Elections—Last date for Nominations.
May 21st.—R.C.V.S. Council Elections—Voting Papers issued.
May 28th.—R.C.V.S. Council Elections—Voting Papers to be returned.
June 4th.—R.C.V.S. Annual General Meeting.
June 4th.—R.C.V.S. Committee Meetings.
June 5th.—R.C.V.S. Committee Meetings.
June 6th.—R.C.V.S. Committee and Council Meetings.

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PERSONAL

Retirement of Sir Arthur Olver, C.B., C.M.G., F.R.C.V.S., F.R.S.E.

[Contributed]

When, in 1938, Sir Arthur Olver was invited by the Board of Governors of the Royal (Dick) Veterinary College to succeed the late Principal Bradley, he had no enviable task before him, for Bradley stood so high in the esteem of our profession and in particular in that of his colleagues in the College, that to be a substitute for him was not possible. Yet, the passing of eight years during which Sir Arthur held this very important position showed with what wisdom the Governors had made their choice, for it may truly be said that in devotion to duty, organizing ability and deep regard for his profession he worthily maintained the Bradley tradition. His previous record of service was such that one expected fulfilment of promise, and we were not disappointed.

Sir Arthur served with distinction in the South African War and in the European War, 1914-18, and gained exceptional and very valuable experience while Expert Adviser in Animal Husbandry to the Government of India. During these years he acquired that broad outlook on veterinary matters so necessary for the head of a teaching institution. Sir Arthur entered on his duties during an interesting phase in the development of the College and successfully supported the endeavour to increase the teaching staff, while he strongly upheld the view that lecturers—as well as professors—needed support and encouragement.

The war added to his difficulties and responsibilities, but he was fortunate in that, unlike his predecessors, he had no teaching duties and could devote the whole of his time to the general supervision and betterment of the College activities, and the College is deeply indebted to him for much earnest endeavour.

Sir Arthur has retired—still at an early age in mind and body, if not in years—to his estate in the South, where it is the writer's earnest hope that one so kindly and courteous will enjoy many years of active life.

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French Academy of Medicine Honours Dr. J. T. Edwards

Our readers will learn with great pleasure of the high distinction—unique, we believe in British veterinary annals—conferred upon our colleague, James Thomas Edwards, D.Sc., M.R.C.V.S., by his election to the Académie de Médécine de France as a Foreign Correspondent in the Division of Veterinary Medicine. A gratifying accompaniment of the notification of the award was the receipt by Dr. Edwards of letters of congratulation from the revered veterinary savant, Dr. E. Leclainche, from Professor Degois, transmitting the felicitations of the Conseil Supérieur, Ordre des Vétérinaires, of which he is President, and from Professor Jean Verge, of the Alfort Veterinary School. Professor Degois, using words which will be warmly endorsed on this side, speaks of the election as "yet another manifestation of the goodwill which the French people feel for their English friends, who reciprocate this," while Professor Verge, with a reference to the honour as "a just recognition of the merits you have shown since together we frequented the laboratory of my esteemed master, Professor Vallée," links the occasion with Dr. Edwards' first personal contact with French Veterinary Science. He spent a year at Alfort (1912-13) as the holder not only of the R.C.V.S. Jubilee Memorial and Bursary Award, but of the first veterinary scholarship awarded under the Development Commission. That then newly instituted body decided that its task of promoting research into the various branches of agriculture was dependent upon the provision of trained staffs and it was under this system of agricultural research scholarships—each tenable for three years—that Dr. Edwards spent the second year under Vallée at Alfort and the Pasteur Institute.

It will afford his British colleagues the deepest satisfaction to know that Dr. Edwards' distinguished service, not only as a scientist, but as one who has placed veterinary literature—and more particularly this journal—inestimably in its debt for his historical researches, should be accorded such outstanding recognition from the French Academy of Medicine.

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An Invitation from Denmark

To the Children of Veterinarians in Great Britain

We have great pleasure in bringing to the notice of our readers the very generous and warm-hearted project which is being planned by the Danish Association of Veterinary Surgeons. In so doing it is felt that we cannot do better than publish this invitation and the President's reply.

Hammel, Denmark.
March 3rd, 1946.

Dear Colleagues,—On behalf of "The Association of Danish Veterinary Surgeons" and as the Association's representative in the "Red Cross," I have pleasure in addressing you.

We know that England has suffered very much in the war—and much more than we have. We know that it is very difficult for many English parents to give their children that good food they want to give, because the rations are very small. Here in Denmark we have (as you know) plenty of good food—milk, butter, sugar, meat, eggs—and now our Association has proposed that we shall invite children from our English brother officials. Alas, we cannot give them clothes (to-day it is impossible to buy clothes here in Denmark) but we want to open our homes for these children and widows, and give them our good Danish food so long as they want. Here in Denmark we will never forget that England has liberated us from the hated Germans—our death enemies— and I hope to hear from you respecting this matter.

I send you best wishes and greetings from the Danish Association of Veterinary Surgeons to the English one.

Yours sincerely,
Frede Precht.

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National Veterinary Medical Association,
36, Gordon Square,
London, W.C.1.
March 18th, 1946.

Dear Mr. Precht.—On behalf of the National Veterinary Medical Association, I thank the Danish Association of Veterinary Surgeons for their generous invitation to our children and others.

Enquiries regarding transport will be made and the invitation publicized in the very near future.

We heartily reciprocate your best wishes and greetings, and look to the friendship and co-operation of our two nations in the future with great hopes.

Yours sincerely,
G. N. Gould,
President of the National Veterinary Medical Association.

Frede Precht, Esq.,
Inseminerende Dyrlaege,
ved Hammelegnens Kvaegavlsforening, Denmark.

Needless to say, if circumstances make it possible, the N.V.M.A. is anxious to do everything in its power to further this scheme, which affords such practical evidence of friendship and co-operation. Arrangements to carry it into effect will be made as soon as the number of children and other dependants of veterinary surgeons likely to be able to take advantage of the invitation can be ascertained, and those of our readers who are thus directly interested are requested to inform the General Secretary accordingly without delay.

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Captain of Scotland's XV.—The many rugby enthusiasts amongst our readers will wish us, in their name, most heartily to congratulate Mr. F. W. Deas, M.R.C.V.S., of the Ministry's staff—the renowned Heriot forward—on his selection as Captain of the Scottish XV to meet Wales at Murrayfield this afternoon. The side shows two changes from that beaten at Twickenham through England's fine second half rally, but Deas fully maintained the splendid form he has shown for Scotland throughout the season.

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Appointments.—The following appointments in the Colonial Veterinary Service are announced: Messrs. A. H. A. Hamilton, M.R.C.V.S. (Veterinary Officer, Nigeria) and R. B. Sherriff, M.R.C.V.S. (Veterinary Officer, Tanganyika), and Miss D. Ritchie, M.R.C.V.S. (Veterinary Officer, Kenya).

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Veterinary Officer at Australia House.—In our issue of March 16th, we intimated the pending arrival in London of Lt.-Col. W. H. Finney, B.V.Sc. Colonel Finney, formerly Veterinary Officer, Queensland, is to take over the duties of Veterinary Officer, London, from Mr. R. H. Heywood, B.V.Sc., as from April 2nd, 1946. Mr. Heywood returns to his position of Executive Officer, London, Australian Meat Board.

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Forthcoming Marriage.—Williams—Harries.—The engagement is announced between Eric I. Williams, M.R.C.V.S., son of Mrs. Williams and the late Mr. J. T. Williams, The Grove, St. Clears, Carms., and Mary, daughter of Mrs. Harries and the late Mr. T. D. Harries, Penllwynau, Nantgaredig, Carms.

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It is regretted that the name of Mr. Esmond Brown was not recorded in the list of those attending the Quarterly Meeting of Council, R.C.V.S., held on January 11th, published in the *Supplement* to *The Veterinary Record* dated March 23rd.

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R.C.V.S. OBITUARY

Macleod, Duncan, 17, Sutherland Street, Hillhead, Glasgow, W.2, Professor of Veterinary Hygiene, Dietetics and Animal Husbandry in the Glasgow Veterinary College. Graduated Glasgow, May 20th, 1904. Died March 18th, 1946.

Professor Duncan MacLeod, M.R.C.V.S.

We learn with deep regret that Professor Duncan MacLeod passed away whilst at his work at the Glasgow Abattoir as a Veterinary Inspector.

In the passing of Professor MacLeod, the veterinary profession has suffered the loss of one whose niche it will be difficult to fill. Throughout his whole career he devoted himself, in his own quiet, unassuming way, to promoting its interests.

After qualifying in May, 1904, Professor MacLeod became Assistant to Mr. McKinna in Huddersfield, leaving his service a few years later to become Assistant to the late Professor McCall, Principal of the Glasgow Veterinary College. This began an association with the College which was to last throughout his life. A few years later Professor MacLeod was appointed Professor of Hygiene which resulted in a life-long interest in the students and endeared him to all who had the privilege of studying under him. In 1911 he was appointed Assistant Veterinary Inspector to the Corporation of Glasgow, a post which he held in conjunction with his position in the College. In this connection he had a profound knowledge of all the scheduled animal diseases and was an expert in their diagnosis.

Professor MacLeod was highly respected by auctioneers, farmers and meat traders alike for his firm and upright dealings. Those of us who came most closely into contact with him learned to regard him not only for his professional worth but for his genial companionship, his pawky humour and shrewd philosophical outlook on life. He despised anything that savoured of ostentation. In his efforts to help others he was untiring and throughout the years of pecuniary embarrassment of the Glasgow Veterinary College Professor MacLeod continued loyally and enthusiastically to give it his full support. Although he has gone from our midst, he has left behind a memory and record of service which will act as an incentive to all who knew him to emulate his example.

The funeral took place on Thursday, March 21st, to the Western Necropolis, Glasgow, and was attended by a large number of his friends and associates. Among those present were Professors J. McCall, Emslie, Dykes, Thomson and Sullivan, and students of Glasgow Veterinary College, Mr. Weipers representing the Governors of the College and Mr. H. Robb. The Corporation of Glasgow was represented by Messrs. Abbott and Nicolson and many members of the Markets and Veterinary Departments.

To Mrs. MacLeod and family we extend our deepest sympathy in their bereavement.

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An Appreciation

Professor George Dykes sends us the following tribute:—

Intimation of the passing-on of Professor Duncan MacLeod will come as a great shock to the hundreds of students who had the privilege of sitting at his feet—not one of whom he ever forgot, and with whom he shared his seemingly inexhaustible store of both general and specialized knowledge.

Somehow we had come to look upon Professor MacLeod as an institution—someone who was permanent and unchangeable. In this we were but recognizing that which preponderated in him—his wisdom, his power and his great love for his fellow creatures.

In the proceedings of the Royal Society it stands on record that Professor MacLeod, whilst House Surgeon at this College, collaborated with a Glasgow surgeon in researches which culminated in the successful anastomosis of nerve for Bell's paralysis. So far as is known, our beloved colleague contributed largely to the first successful anastomosis of nerve in animals which led to the inestimable benefits of nerve anastomosis in the human subject. Again, the records show that whilst House Surgeon to Principal MacCall, Professor MacLeod was of great service to him in the achievement of much work of outstanding value to posterity.

It is not, however, mainly for his great gifts that we will remember this great Highland gentleman, but for his kindliness and unlimited capacity for affection. Our hearts go out to his wife and family in their grievous loss.

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The Veterinary Educational Trust

Dr. Wooldridge Appointed Scientific Director

It is now three years since the foundation of the Veterinary Educational Trust. Since then it has received generous support from individuals, corporate bodies, and industrial firms interested in its aims and has collected funds (some under covenant) amounting to more than £300,000. The Council having decided that the work of the Trust should begin, several undergraduate scholarships and postgraduate research fellowships have been awarded. It is hoped to give greater assistance in the future to veterinary education (both undergraduate and postgraduate) and to research. As announced below, an equine research station is to be established at Newmarket and later a canine research station elsewhere.

In view of these growing commitments, members of the Council and the Committees of the Trust, as well as many of its financial supporters, have been pressing for some time for the appointment of a veterinarian to be responsible for its proper development. Recently it was decided that a Scientific Director should be appointed and the post was unanimously offered to Dr. W. R. Wooldridge. After consultation with the authorities of the London School of Hygiene and Tropical Medicine, Dr. Wooldridge has agreed to accept the post, but at first in a part-time capacity. He will commence his new duties at the beginning of April and will continue to lecture at the School, which will remain his headquarters for the time being.

We welcome the creation of this new post, not only as an indication of the growth and expanding activities of the Trust but also because it will make for the greater success of its work.

Equine Research Station

A noteworthy phase in this expansion of activity was, in fact, announced on Tuesday last, in that, through the generosity of Lady Yule and Miss Yule, the Trust is to have the free use of Balaton Lodge racing stables, Newmarket, as an equine research station, with particular application to the thoroughbred. Dr. W. R. Wooldridge will, as Scientific Director, have general supervision of educational and research activities, including that of the new research station. An expert residential and consulting staff, which will include Professor Brayley Reynolds and Mr. Fred Day, will be needed at Newmarket, and it is estimated that the annual cost of maintenance and upkeep will be about £20,000. As our readers are aware, the Trust has a bloodstock industry committee under the chairmanship of Major Durham Matthews. If its work is to be prosecuted with vigour and certainty over a long term of years, the Trust, it is stated, will need a larger annual income.

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Government Plans for the Promotion of National Health

Enlargement of the Public Service

Medical Reactions

The National Health Service Bill, together with its associated summarizing and explanatory White Paper (Cmd. 6761, H.M.S.O., 3d.), gives legislative form to the Government's plans for enlarging the public health service in England and Wales, inaugurated some 30 years ago, into a comprehensive service for all. The present scheme, however—the third Government plan though the first Bill—has grown out of the proposals made by the war-time Coalition which were published in the White Paper of February, 1944. A Bill for Scotland is to follow. It is hoped that the scheme will operate from the beginning of 1948; its cost will, in the early stages, approximate £152,000,000 a year. All of the services provided under the Bill will be available to everyone: they will not be conditional on any insurance qualification.

The main proposals relate to the provision of (1) a hospital and specialist service and (2) a health centre and family doctor service, with important supplementary services.

Mr. Bevan's Bill places all hospitals, voluntary and municipal, in the hands of the Ministry of Health, for participation in a unified hospital service, but delegating most of their administration to 16 to 20 regional boards, responsible for developing the best possible hospital and consultant service for that region. These hospital service regions will be such that their services can conveniently be associated with a university medical school. Special arrangements are made for the teaching hospitals, which, individually or grouped, will have their own board of governors, including members nominated by the university, the regional board for the area, the service staff of the hospital itself and members appointed after consultation with the major local authorities and other organizations concerned, including the previous governing bodies. Medical and dental schools are not to be transferred to the Minister. They will continue to be owned and administered, in London, by their own governing bodies, and elsewhere by the universities of which they form a part.

Interesting proposals are made for dealing with hospital endowments. In the case of the voluntary teaching hospitals these will pass directly to the new boards of governors; those of other voluntary hospitals will pass to a new Hospital Endowment Fund, to be administered by the Minister.

The Practitioner and the Service

The service of family doctors, dentists and chemists is to be organized by local executive councils and based upon the health centres. The members of these councils will be nominated in equal numbers by the major local authorities and the Minister and by the local practitioners. All doctors who choose to join the service will be in contract with the councils, and each doctor will have his own list of patients whom he has agreed to attend, and will be able, as will dentists, to use the health centres in place of surgeries. The patients' freedom in the choice of doctor is not cancelled, neither will there be a general direction of doctors. There will, however, be a certain amount of control of their movement within the national service. Payment of doctors will be by part-salary and capitation fees. Choice of doctor will be made from the list of those joining the service, but his remuneration will come from public funds and not from the patient direct. A doctor can make private arrangements for treating, at a private fee, those who wish to remain outside the service. Medicines, drugs, or appliances will be supplied free of charge on a doctor's prescription by any pharmacist who has joined the service, which any qualified chemist will have the right to do.

The establishment of new publicly equipped health centres is one of the main features of the personal practitioner service, and the Bill makes it the duty of County and Borough Councils to provide, equip, staff and maintain these new centres. A Central Health Services Council will be set up to furnish the Minister with professional and technical guidance.

The sale of practices which are wholly or partly within the National Health Service will be prohibited, and compensation will be paid to present practitioners for loss of selling values. In agreement with the doctors' representatives a figure of £66,000,000 has been fixed for the capital value involved, of which £58,500,000 is estimated to apply to England and Wales. The distribution of compensation will be left to the profession, and the Minister will accept any reasonable proposals within the total sum. Normally compensation will be paid on retirement or death.

To meet the needs of areas which are short of doctors payment to doctors will be adjusted to induce them to enter these areas, and a mainly professional body, the Medical Practices Committee, will be set up to regulate the succession to old or the opening of new practices within the service.

To keep practitioners abreast of developments, refresher courses at university or medical schools are provided for, the Minister contributing towards their cost and paying the expenses of those attending.

Compulsory Vaccination to End

The preventive aspect of the service includes the provision that the principle of compulsory vaccination is no longer to operate. Free vaccination and diphtheria immunization will be provided for all those who desire them.

The B.M.A. and the Bill

The Council of the British Medical Association has submitted a report on the Bill for the information of the profession.

The statement emphasizes that the medical profession is anxious and willing to co-operate with the Government in evolving a complete health service, but is opposed to certain important features of the Government's proposals. For years the doctors have been pressing for a complete medical service; their objections are to some of the means proposed. It is insisted that the answer to three things—the direction of medical practitioners, their payment mainly by State salary, and the prohibition of the sale of practices—means a whole-time salaried service, sooner or later, under the State—that is, control.

In the patient's interest it is pointed out that the doctor should be independent within his field. Inevitably there will be an urge on the part of the State to cut short all sickness to save funds and man-power. There will be the motive for pressure and the means to exercise it. A doctor will be able to set up in practice or to change his area only with official approval, which would be direction; and make progress in his profession only with official approval, which would be to become a Civil servant. The loyalty of the doctor to his patient should be limited only by his conscience, and not by fear of Whitehall.

It is stated that the taking over by the State of the ownership of all hospitals must cause a loss of local interest and the discouragement of support by contributions or service. Local hospitals command pride, resource and initiative; help, innovation, staffing and confidence. These must be preserved.

Health services, the statement adds, need a single administration; the Government proffer three, one for the general practitioner, a second for the hospitals, and a third for public health. The council complains that six different Ministers, as well as the Ministry of Health, will all be running their own forms of medical service. The Minister of Health should be responsible for all health services and should do no other job.

The Lancet concludes a well-balanced study of the Bill with the words: "It is easy to be too much afraid. We should ask ourselves whether, with all its risks, the Service contemplated does not give us opportunities. It is a great end—that whatever person can benefit from medical knowledge or skill shall have it without hindrance. The means now proposed to that end may need modification, but they certainly do not call for wholesale condemnation or irreconcilable opposition."

Meetings of the profession are to be called in every area during the next few weeks.

Sir Bernard Docker, Chairman of the British Hospitals Association, has said that of all the proposals under the Bill the most revolutionary was the liquidation of the voluntary hospitals by their transfer to the State, which process he describes as "the mass murder of the hospitals." The hospital service part of the Bill was "just a mass of mechanism in which the patient will get caught and mangled." It was part and parcel of the Minister's plan to indulge in the insidious process of tampering with trust funds. The whole of the Minister's object and the best interests of the patient could be secured within a comprehensive free National Health Service without throwing away the priceless asset of the voluntary hospitals.

PUNJAB VETERINARY COLLEGE APPOINTMENT

In conjunction with the post of Professor of Pathology at the above College, applications for which are invited in our advertisement columns, anyone interested in the appointment can obtain further helpful details on reference to the General Secretary, N.V.M.A., 36, Gordon Square, London, W.C.1.

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THE BRITISH ASSOCIATION

The British Association has found it impossible to arrange this year an annual meeting similar to meetings held in provincial cities before the war. A one-day meeting will therefore be held on Saturday, July 20th, in London. The British Medical Association has granted the use of its hall. The presidential address will be delivered by Sir Richard Gregory. There will be no sectional meetings. Delegates attending the Empire Scientific Conference organized by the Royal Society, and the Commonwealth Scientific Official Conference, will be received at a luncheon, and at the subsequent meeting.

It is intended to resume normal meetings in subsequent years, and an invitation has been accepted for the meeting in 1947 to be held in Dundee, where it was cut short in 1939 by the imminence of war. An invitation from Brighton for 1948 has also been accepted.

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NEED FOR A UNIFIED SYSTEM OF ANIMAL-DISEASE CONTROL

Dr. W. R. Wooldridge, who, as announced in another column, has been appointed Scientific Director of the Veterinary Educational Trust, in a recent address at Taunton gave strong support to the emphasis already placed upon the need for close collaboration between the State, the veterinary profession and the farmers in any plan for the control of the diseases of dairy cattle. It was, therefore, surprising (proceeded Dr. Wooldridge, as reported in *The Farmers' Weekly*) that the recent reorganization within the Ministry of Agriculture should have led to a divided responsibility in such matters. In the White Paper on Milk it was clearly indicated that an active policy embodying the control of disease, the testing of milk, and the improvement of livestock was to be initiated under the supervision of the Ministry's Chief Veterinary Officer. Despite the obvious sound scientific basis for this organization it seemed that they were now to envisage an Animal Health Division concerned with disease; a Division of Livestock Improvement and Dairy Husbandry concerned with breeding, recording and milk quality; and an Advisory Service tackling everything from crops to animal husbandry. It was suggested that the rearrangement was administratively necessary and that those various divisions would be carefully co-ordinated by the Ministry's Permanent Secretary. It was clear that such an arrangement was unlikely to be practicable and that the divided responsibilities for measures so intimately bound up with the improvement of animal health were unlikely to succeed, unless they are all brought within the ambit of the Chief Veterinary Officer.

On the pasteurization issue Dr. Wooldridge said that in view of the dangers of milk infection from those handling it during distribution it might have been expected that the section of the community most clamorous for universal pasteurization would have been the farmers themselves. For the maximum market could only arise when the retailed liquid milk was known to be both wholesome and safe, and when it was of the highest keeping quality. That simple fact did not yet seem to be appreciated by all producers, nor did they appear to realize that the consumer would the more readily purchase a pasteurized good quality milk than a pasteurized poor quality milk. Pasteurization was not an alternative to disease control in the herds, but was complementary to it. "I can see the day when the producer will insist that the milk which he has been at such pains to produce in a wholesome and safe condition shall be prevented by pasteurization from suffering contamination at the hands of those subsequently handling it."

Dealing with the most serious diseases which affect milk production, Dr. Wooldridge said the most obvious one was mastitis. Tuberculous mastitis was present in herds to the extent of about one-half per cent. and was rightly considered a serious menace to public health.

He was frankly amazed to hear Mr. Price, who was to be responsible for the agricultural advisory service in the South-West region, publicly exclaim recently that too much fuss was being made of tuberculosis in dairy cattle. He hoped he was misquoting Mr. Price, for such advice was certainly not in keeping with the best interests of producers.

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EMPHASIS NOW ON MILK QUALITY

In his recent speech at Durham, Sir Thomas Baxter, Chairman of the Milk Marketing Board, said that during the war it had been necessary to develop milk production upon a quantitative rather than a qualitative basis. Now the problem of quality had become a vital, pressing matter. "During the last seven years farmers have done a magnificent job in giving the nation so much milk, but the time is coming when we shall have to think, not in terms of quantity, but in terms of milk in the form that the nation requires it and that will be milk of good, pure quality," Sir Thomas declared.

"There is the task immediately ahead of us. I, for one, would not hesitate to say that the job of improving the quality of our milk is as important as, if not even more important than, has been our task of producing milk during the war years in sufficient quantity to supply the nutrition that the nation needed.

"The members of the Milk Marketing Board are clear as to what the future policy for milk production in this country must be. They foresee a gradual but steady progress towards the elimination of all animals affected with disease, and, particularly those infected with tuberculosis. The nation will demand pure milk and that must inevitably mean that all milk of this country must be, at least, of T.T. standard. The process of bringing the national dairy herd up to T.T. category is a vast project but, in its sublime conception, is a job well worth while and one that will raise the contribution of dairy farming to the future weal of the nation to a plane far above any yet reached.

"The Board are anxious to enlist the full co-operation of the Government in a scheme—and it will again be a very long-term scheme—which will ensure these standards being reached probably within 20 years time. It does not matter how long it takes providing you get there, as get there we must. Unless we tackle this great task now, unless we proceed systematically to work up to the standard we have set, we shall merely be putting back the clock and those who follow us in 20 or 30 years will have to face the same problem. The solution to our problem is the ultimate production of milk in this country of a standard that cannot be assailed, milk that can truly be described as the national food, the supreme food."

Mr. Sidney Foster, general manager of the Milk Marketing Board, speaking at Exeter last week, said that to ensure non-priority customers a daily half-pint of milk would demand an increase of 20 per cent. in the production of every cow. The Board believed in progress through an improvement in the quality of the cattle rather than in adding to the number of cows, and its long-term objective was to produce throughout the country milk of tuberculin-tested standard. Nothing less would satisfy the needs of the consumer or the ideals of the progressive farmer. In the next four years it was expected that 25 Milk Marketing Board artificial insemination centres would be opened in England and Wales, and to encourage a more intelligent use of recording from a national standpoint the Board were about to create a central bureau of records.

Another record for winter milk production was established in February, when the total sales in England and Wales, through the Milk Marketing Board, were 92,134 000 gallons, an increase of 7,645,000 gallons compared with February, 1945, and 17,983,000 gallons above the figure of February, 1939.

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ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

FOOT-AND-MOUTH DISEASE:

Dunbartonshire.—Dalmonach House, Alexandria, Dunbartonshire (Mar. 22nd).

SWINE FEVER:

Berks.—"Mayfield," Farmoor, Oxford (Mar. 23rd).

Cumberland.—Castletown, Rockcliffe, Carlisle, Cumberland (Mar. 23rd).

Essex.—Bridgeman's Farm, Barrow Hall Road, Little Wakering, Rochford, Essex (Mar. 19th).

Lincs. (*Kesteven*).—Lane Farm, Morton, Bourne, Lincs.; Middle Farm, Boothby Graffoe, Lincoln (Mar. 21st).

Lincs. (*Lindsey*).—Meagram Cottage, Hainton, Lincoln (Mar. 21st); Little Steeping, Spilsby, Lincs. (Mar. 20th).

Lincs. (*Holland*).—29, South Street, Crowland, Peterborough, Northants. (Mar. 20th).

Norfolk.—Salter's Road Allotments, King's Lynn, Norfolk; Estuary Farm, North Lynn, King's Lynn, Norfolk (Mar. 21st).

Surrey.—The Vines, Pirbright Road, Normandy, Guildford, Surrey (Mar. 19th); Lane End Farm, Chobham Road, Knaphill, Woking, Surrey (Mar. 22nd); Farleigh House Farm, Farleigh, Warlingham, Surrey (Mar. 25th).

Worcs.—158, Studley Road, Redditch, Worcs. (Mar. 22nd).

SHEEP SCAB:

Merioneth.—Tyddynmawr Farm, Talybont, Merioneth (Mar. 18th).

LATE MINISTRY ANNOUNCEMENT

Contagious Abortion : Calfhood Vaccination Scheme

Extension to All Attested Herds

As we go to Press, the following announcement has been received from the Ministry of Agriculture and Fisheries:—

Over 200,000 heifer calves in dairy herds were vaccinated last year under the Calfhood Vaccination Scheme. There were difficulties at the outset over the supply of vaccine, but the position improved greatly during the later months of the year and the volume of supplies is now satisfactory.

The Scheme has hitherto been limited to dairy herds subject to routine veterinary inspection, vaccination of heifer calves of four months old and upwards and maiden heifers up to the time of first service being carried out when a veterinary inspector visits the farm for the purpose of inspecting the dairy herd. The Ministry of Agriculture and Fisheries has now decided to extend the Scheme to all Attested Herds, whether dairy herds or not. Vaccination will be carried out at the time of tuberculin tests of the herd. The charge to the farmer will be the same as in the case of dairy herds, namely, one shilling per calf.

Vaccination offers the best means of controlling contagious abortion and the Ministry urges all dairy farmers and owners of Attested Herds to take full advantage of the Scheme.

Application to join the Scheme should be made to the Divisional Veterinary Inspector of the Ministry.

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H.M. STATIONERY OFFICE PUBLICATIONS

The undermentioned have been published recently. Copies can be purchased through any bookseller, or directly from H.M. Stationery Office.

House of Commons Bills (Session 1945-46):		
94. National Health Service. Bill to provide for the Establishment of a comprehensive Health Service for England and Wales and for purposes connected therewith	1 3	1 5
Command Papers (Session 1945-46):		
(6761.) National Health Service Bill. Summary of the Proposed New Service	0 3	0 4
(6757.) United States. Agreement between His Majesty's Government in the United Kingdom and the Government of the United States of America on the Principles applying to the Exchange of Information relating to Synthesis of Penicillin. Washington, January 25th, 1946. (Treaty Series No. 4, 1946.)	0 2	0 3
Statutory Rules and Orders, 1946:		
323. Artificial Insemination. Importation and Exportation of Semen and Imported Semen (England and Wales) Regulations. March 7th. (Published March 12th, 1946.)	0 1	0 2
334. Improvement of Livestock (Licensing of Boars) (Scotland) Regulations. S.12. March 8th. (Published March 15th, 1946.)	0 3	0 4
Public General Acts (10 Geo. 6) (Session 1945-46):		
Ch. 29. Agriculture (Artificial Insemination) ...	0 1	0 2

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal views of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.

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HEPATIC DISEASE RESEARCH

Sir,—There have been of late in the medical Press certain references to work of medical research which is of more than passing interest to the veterinary profession, concerning investigations into the cause of certain liver conditions which occur in man and experimental animals. The changes seen are those of fatty infiltration, hepatic cirrhosis, and atrophy of the liver. It appears that certain of these lesions can be produced experimentally in laboratory animals and further it is suggested that in several diseases in which, *e.g.*, a fatty liver condition is present, the causal factor may be in reality a dietary deficiency and not as was formerly believed a toxic one.

It is impossible in a short letter to give in any way the scope or implications of this recent work, but it opens up new fields of research in several of the diseases affecting domestic stock, in particular the possibilities for experimental work on pregnancy toxaemia of the ewe. On theoretical grounds, there seems to be already a case for attempting treatment of this complaint with either methionine or a similar preparation. One might also draw attention to the frequency with which one finds a fatty condition of the liver present at *post-mortem* examination in cows which have failed to respond to milk fever treatment. In this connection I quote from one of the aforementioned references, "When the liver is sliced at autopsy and found to be fatty, the finding is not usually looked on as of real significance in deciding the cause of death. Fatty liver is quite common in a wide variety of unrelated diseases and is thought to be a 'terminal event.' But improved methods of liver biopsy, such as that described by Sherlock, may well demonstrate that fatty liver is sometimes not so much a terminal event as a terminating mechanism." The implications here, whilst not in any way comparable with those as regards pregnancy toxaemia, would seem to be a pointer at least giving a new avenue of approach to elucidating the underlying mechanism of the milk fever syndrome. These are two important conditions which jump to mind, but there must be others where this new work will play an important part in any further research into their underlying causes.

In conclusion, one might add that, judging from the trend of modern medical research, it looks very much as though the vitamins must make way for the protein deficiency and in particular the amino acid deficiency. Whilst we in practice can only note and appreciate the possibilities of the work, we trust that our veterinary research workers have already noted these new developments and will be in a position before long to announce increased research on similar lesions occurring in the diseases amongst our farm animals. In the meantime I must continue, in these "acute derangements of metabolism," to inject the necessary blood constituents as they fall below the critical level, namely, the glucose or the calcium or the magnesium as the case may be.

Yours faithfully,

Blackburn, Lancs. Alexander H. Hogg.
March 17th, 1946.

References

The Lancet, November 24th, 1945.
Ibid., February 23rd, 1946.

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THE RIGHT TO PRACTISE

A Plea for Reciprocity with the Dominions

Sir,—I should like to impress upon my British colleagues that the moment is opportune for complete reciprocity with the Dominions in the matter of veterinary right to practise. It is evident that something like a new urge to emigrate is taking shape in Britain, and that veterinarians are among those who would go overseas.

There is, at the present time, ample scope in Australia and New Zealand for the useful employment of many more veterinarians than are becoming available from the Sydney Veterinary School. Australia alone is believed to be short of nearly 700 veterinarians. New Zealand, which has no school of its own, has no special reason to prefer Australian graduates, and consequently has taken many veterinarians from Britain, but it is significant that none of the Australian States so far has asked its London representative to obtain veterinarians from the Old Country.

No Australian graduate has ever complained to me about the matter, but I am fairly sure that one reason for the difference between Australia and New Zealand is a possible feeling of Australian resentment against the lack of reciprocity on the part of the R.C.V.S.

In my view veterinary academical education in Australia, as judged by results, is fully equal to British standards and in some branches is probably higher. If the proposed new curriculum for an Australian National Veterinary School with greatly expanded facilities is put into effect, British schools will have to be very good indeed to keep level with Australian standards.

It is therefore submitted that the R.C.V.S. could do no better service to those of its young members who would like to gain experience in this great Dominion than to remove the slur upon the Sydney qualification implied in the existing lack of reciprocity. It does not matter that no slur is intended and that the reason for excluding Australian veterinarians is a purely legal or technical one—what matters is the fact that I, for instance, am received on equal terms here while my Australian colleague who goes to Britain is disqualified.

Yours faithfully,

Scottsdale, Tasmania, N.B. J. W. Rainey.
February 24th, 1946.